# SPECTROSCOPY APPLICATION FOR CHARACTERIZATION AND IDENTIFICATION OF THE ARTIFICIALLY COLOURED DIAMONDS

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## Abstract

There are still some concern about mechanisms of defects transformations and structure of some lattice defects in diamonds. This work is performed for better understanding the processes which take place in diamond lattice during irradiation and annealing.

Samples of artificially colored natural and synthetic diamonds were investigated by the means of standard gemological equipment (e.g. UV-lamp, microscope) and also VIS-range absorption spectroscopy (at room temperature), spectral (at room and liquid nitrogen temperatures) and color cathodoluminescence, and laser induced photoluminescence (lasers with wavelengths of 488 nm at the room temperature). Among studied samples there are several octahedral natural diamond crystals, synthetic diamond crystals, flat plates cut from natural and synthetic diamonds. Several samples (natural octahedral diamond crystal) have undergone annealing at the temperatures of 1700-1800 degrees C under high pressure (6 GPa) during 5 hours and some samples (octahedral natural diamond crystals, natural and synthetic diamond flat plates) were irradiated by protons. Irradiated samples then were annealed at the different temperatures in the range of 800-900 degrees C. At every stage spectroscopic data was acquired.

The color of the annealed samples has changed from brownish to yellow-green. In the absorption spectra of the annealed samples there were viewed increasing of 415 nm line (N3-center) and appearing of 503 nm line (H3-center). In the laser photoluminescence spectra of the annealed diamonds there were viewed appearing of intense H3-center line at 503 nm. Images of the color cathodoluminescence of the annealed samples revealed changing of color (from blue to green) in the luminescence.

The color of the irradiated samples has changed to green for natural diamonds and to greenish-yellow for synthetic diamonds. In the absorption spectra of the irradiated samples there were viewed appearing of 503 nm line (H3-center). Images of the color cathodoluminescence of the irradiated natural diamond samples revealed no changing of color and distribution of luminescence (remain blue). Images of the color cathodoluminescence of the irradiated synthetic diamond samples revealed changing of the intensity of luminescence: weakening of red cathodoluminescence.

Acquired data provide a useful information on causes of diamond color, mechanism of the transformation and stability of lattice defects in diamonds and can be useful for gemologists in the identification of annealed and irradiated diamonds.